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APPLICATION FOR LETTERS PATENT

**SYSTEM AND RELATED METHODS FOR MANAGING AND  
ENFORCING SOFTWARE LICENSES**

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# SYSTEM AND RELATED METHODS FOR MANAGING AND ENFORCING SOFTWARE LICENSES

## RELATED APPLICATIONS

5           The following patent application is related to the present application, is assigned to the assignee of this patent application, and is expressly incorporated by reference herein:

- 10           • U.S. Patent Application Serial No. 09/040,813, entitled “System and Method for Software Licensing”, filed on March 18, 1998.

## TECHNICAL FIELD

15           This invention generally relates to the management and enforcement of software licenses, and, more particularly, to a system and methods for automatically managing and enforcing terminal server software licenses through a “leased license” approach.

## BACKGROUND

20           Software licensing has historically been based on a “trust” model in which the user (i.e., licensee) is presumed to be honest and trustworthy and to abide by the terms of the license. Under the trust model, a software license typically accompanies a software product to explain the terms of use. For instance, the software license might dictate that the program code is to be installed on only one computer, and may be used to make one backup copy.

25           Common types of licenses include “shrink wrap” licenses, “online” licenses, and “site” licenses. A “shrink wrap” license is a license that

accompanies each software product that is sold individually in a shrink-wrapped package through, for example, retail stores. The user is typically assumed to accept the terms of the shrink wrap license upon breaking the seal of the package, or the container that holds the disk itself.

5       An “online” license is one that accompanies software products that are downloaded online, such as from the Internet. The license is typically presented to the user prior to downloading the code. The user is presented with a choice to accept or reject the license. If the user accepts the license (e.g., by clicking an “Accept” button on the screen), the user is presumed to have accepted the terms of  
10       the license and the code is downloaded to the user’s computer.

      A “site” license is a single license that allows installation of multiple copies of software on many different computers at a particular site or many sites. It is commonly used to sell software to corporations, firms, or other entities having many computers. The purchaser pays for a certain number of copies (e.g.,  
15       hundreds or thousands), and the site license enables the purchaser to install that number of copies on its computers. The site license is beneficial because the software vendor need not supply a large number of program disks, but merely supplies one or a few copies of the software and lets the purchaser install the copies without violating the agreement.

20       Unfortunately, enforcing each of the above licenses is impractical, if not impossible in certain situations. Users may, purposefully or inadvertently, make multiple copies of the software code and install it on more computers than the license allows. Yet, software vendors have difficulty monitoring these abuses because they occur in the privacy of the home or company. Thus, it is believed

that the software industry loses a large percentage of revenues each year simply due to illegitimate use of software by the licensees.

Another problem with conventional software licensing practices concerns internal monitoring and bookkeeping on the part of large-site licensees. In most cases, the licensees want to comply with the terms of the software licenses, but are unable to adequately track the software as it is used throughout the site. For example, a large corporation might purchase several thousand copies of the software and begin installing the copies. However, computers and personnel change over time and it is difficult to centrally monitor how many copies have been installed, whether the copies have expired, whether they need upgrading, and so forth.

A type of “per-seat” or “per-device” software licensing is terminal server licensing, which provides remote clients with access to terminal server resources such as remotely executable software applications. Terminal server technology, such as that made available by the Windows® 2000 Terminal Services product from Microsoft Corporation of Redmond, Washington, allows a wide variety of different client computer devices including personal desktop computers, laptop computers, notebook computers, handheld computers, Apple Macintosh workstations, UNIX workstations, and the like, to remotely execute applications on a terminal server over virtually any type of network connection. Terminal server licensing permits the monitoring and distribution of purchased software licenses and thus prevents the abuse by users who would make multiple copies of software code and install it on more computers than a license allows.

One method of per-seat terminal server licensing involves the use of a licensing clearinghouse through which customers purchase software licenses

which are sent to license servers that maintain an inventory of available software licenses. The license server is responsible for distributing the software licenses to individual clients. It monitors the software licenses that have been granted to clients and continues to distribute licenses as long as non-assigned licenses remain available. Once the supply of non-assigned licenses is exhausted, however, the license server can no longer grant licenses to the clients, and the customer must purchase additional licenses from the license clearinghouse.

Per-seat terminal server licensing is typically enforced (e.g., in the Windows® 2000 Terminal Services product) by putting a "ticket" onto a client machine that indicates the machine is licensed to access the terminal server. When an unlicensed machine talks to a terminal server, the terminal server attempts to get a license for the machine through the license server. The license server provides the "ticket" which gets pushed down onto the client machine, presumably to remain there permanently, so that whenever that particular client machine connects to a terminal server, the terminal server recognizes it as having a license because of its "ticket".

Although this method of licensing avoids some of the problems encountered in the conventional software licensing schemes described above, such as the abuse by users who make multiple copies of software code and install it on more computers than a license allows, and difficulties with internal monitoring and bookkeeping on the part of large-site licensees, various disadvantages remain.

For example, loss of the per-seat licensing information, or the "ticket", on a client machine, results in various problems. Loss of the "ticket" on a client machine may occur because of a hardware or software failure, but typically is the result of reinstalling the operating system, reformatting the hard drive, or

otherwise refreshing the system prior to giving the machine to a new employee after a previous employee leaves. Once the client machine loses its "ticket", and then attempts to access a terminal server, the terminal server won't recognize the machine as having a license and will attempt to get a new license from the license  
5 server. If the license server has available licenses, it will provide a new "ticket" for the client machine. If not, the machine will not be able to connect to the terminal server. At some point, due to employee turnover and other factors, this process leads to a depletion of a customer's available pool of purchased licenses. The result is that the customer must either purchase extra licenses and make them  
10 available on the license server, or attempt to recover the use of prior licenses which became unusable when the original client machines on which they resided were refreshed. The disadvantages of this licensing method therefore include multiple licenses being issued to the same client machine, customers paying for extra licenses which are not being used, and customers having to go through the  
15 manual and arduous task of contacting the license clearinghouse and having prior lost licenses made available again on the license server for distribution to client machines.

Accordingly, the need exists for a new approach in managing and enforcing per-seat terminal server software licenses that assists customers in monitoring their  
20 own compliance with licensing agreements, ensures that customers comply with licensing agreements, prevents customers from paying for extra licenses that are not needed, and automates the process of reviving lost licenses to avoid the manual task of reclaiming lost licensees through the license clearinghouse.

## SUMMARY

This invention concerns a system and method for managing and enforcing software licenses through automating per-seat software licensing using a “leased license” approach. In addition to providing vendors with the assurance that purchasers are complying with software licenses, the invention maximizes a customer’s use of purchased software licenses while eliminating the difficulties previously associated with a customer monitoring its own compliance with software licenses.

The invention provides a way to enforce permanent licenses automatically by repetitively expiring leased licenses and making those expired licenses available again for use by individual client computers. An exemplary system includes a licensing clearinghouse which generates valid software licenses, a license server which maintains and distributes an inventory of software licenses purchased from the licensing clearinghouse, and multiple clients located at or affiliated with a customer company or other customer entity.

Terminal servers may act as intermediaries for clients that might not have network connectivity to the license server. In addition to acting as common servers that provide resources to clients, terminal servers include the ability to facilitate connectivity to the license server for purposes of distributing software licenses to the clients. Individual clients include various computing devices, such as desktop personal computers, workstations, laptop computers, notebook computers, handheld PCs, and the like, in addition to simpler, low cost machines or terminal devices having limited local processing and local memory.

In an exemplary system, a company purchases software licenses through a licensing clearinghouse. A license generator at the licensing clearinghouse creates

a license pack containing a set of one or more individual software licenses. The license generator verifies the license pack for installation on a license server and sends the license pack to the license server using standard communications. The license server is responsible for maintaining an inventory of software licenses that have been purchased from the licensing clearinghouse and distributing the licenses to individual clients.

In a first implementation of the invention, when a client connects to a terminal server, the terminal server determines whether the client has been issued a license. If the client has not been issued a license, the terminal server assists the client in obtaining a license from a license server. If a license server is not available, the client is denied access to the terminal server resources. Assuming a license server is available and has an available license, the license is issued and pushed down to the client. Although the license is a permanent license, the license server assigns a random expiration date to the license. Thereafter, each time the client connects to the terminal server prior to the expiration date of the license, the client is permitted access to the server. When the client connects to the terminal server on or after the expiration date, the terminal server submits a license request to the license server. If the license server has an available license, it issues the available license with a new expiration date, and pushes the license down to the client. If the license server does not have an available license, no license is issued, and the client is denied access to the terminal server.

In addition, the license server automatically returns the original license to its pool of available licenses on the expiration date of the license. Thus, in the first implementation of the invention, upon connecting with the terminal server on or after the expiration date, the client will be issued the same license it was originally



issued having a new expiration date, and therefore maintain accessibility to the terminal server. A benefit of the invention is therefore made clear by the scenario in which the client computing device loses its original license due to, for example, wiping the hard drive when a new employee is assigned to the client computing  
5 device. Where prior licensing schemes require human intervention to reactivate the lost license, the invention automatically makes the lost license available again for use by a client on the expiration date of the license.

Additional and more comprehensive implementations of the invention facilitate a more realistic network computing environment in which numerous  
10 clients are vying for the available licenses from a license server's pool. A first example includes the license server issuing a temporary license to a client when the license server does not have an available permanent license. This situation arises when a client loses its permanent license prior to the license expiration date. In this case, when the client connects to a terminal server, the terminal server  
15 makes a license request to the license server, and the license server issues a temporary license with a temporary period which provides access to the terminal server for the client. Thereafter, each time this client connects to the terminal server during the temporary period, the terminal server requests a permanent license from the license server to replace the temporary license. Therefore, once  
20 the client's lost license reaches its expiration date and is automatically returned to the license server's available pool, the license server sets a new expiration date and pushes this same license down to the client the next time the client connects to the terminal server, thus replacing the client's temporary license. This assumes that the temporary license has not already been replaced by a new license prior to  
25 the expiration of the lost license. Only if the license server fails to acquire an

available license by the end of the temporary period, will the client be denied access to the terminal server. Thus, as licenses from additional clients expire and are returned to the available pool, a given client will receive a license prior to the end of the temporary period, and not be denied access to the terminal server.

5 In yet another implementation, a license update period is additionally provided in which the terminal server assists a client in renewing the client's current permanent license prior to the expiration date of the license. During the update period, each time the client connects to the terminal server, the terminal server submits a license update request to the license server. If the issuing license  
10 server is available, it will recognize the client as already having a valid license which needs an updated expiration date. The license server will then update the expiration date and provide this "same" license back to the client. If the license server is not available, the client is permitted access to the terminal server since its current license has not yet expired. If the client has not renewed its license in this  
15 manner by the expiration date of the license, then the license server will provide a new license to the client as described above, and the client should continue to have terminal server access.

Thus, through leasing licenses to clients and continually expiring and re-  
leasing them in a way that nets out the overall distribution of purchased licenses,  
20 customers will not lose the use of licenses that are wiped off of client computers due to events such as employee turnovers, and vendors will be assured that their licenses are enforced since the licenses cannot be improperly transferred or otherwise violated.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The same reference numbers are used throughout the drawings to reference like components and features.

**Fig. 1** illustrates an exemplary system for licensing software.

5      **Fig. 2** illustrates an exemplary computing environment which is suitable for implementing various computing devices within the software licensing system.

**Fig. 3** illustrates components within an exemplary software licensing system and various software and hardware elements included in the components.

10      **Fig. 4A** is a flowchart illustrating the general method of managing and enforcing software licenses implemented by an exemplary software licensing system.

**Fig. 4B** is a continuation of the **Fig. 4A** flowchart illustrating the general method of managing and enforcing software licenses implemented by an exemplary software licensing system.

15      **Fig. 4C** is a continuation of the **Fig. 4A** flowchart illustrating the general method of managing and enforcing software licenses implemented by an exemplary software licensing system.

## **DETAILED DESCRIPTION**

### **Exemplary System for Software Licensing**

**Fig. 1** illustrates an exemplary system **100** for licensing software in which the invention may be implemented. Aspects of the exemplary system **100** not fully developed in the following description are described in more detail in the co-pending patent application entitled, “System and Method for Software Licensing”, incorporated by reference above.

The system **100** has a licensing clearinghouse **102** that creates and issues valid software licenses to one or more companies, firms, agencies, or other entities, as represented by company **104**. In a particular embodiment, the clearinghouse **102** is a separate entity from the company **104**. Examples of the clearinghouse **102** include a software manufacturer, a software vendor, or a third party agent that is authorized to issue software licenses on behalf of the software manufacturer or vendor.

In general, the exemplary system **100** allows a company **104** to purchase software licenses through the licensing clearinghouse **102** so that it may run software on company servers or computers. A license generator **106** at the clearinghouse **102** creates a “license pack” containing a set of one or more individual software licenses. The license generator **106** sends the license pack to a license server **108** using standard communications, such as a data communication network (e.g., Internet) or a portable data medium (e.g., floppy diskette, CD-ROM, etc.). The license generator **106** prevents the license pack from being copied and installed on multiple license servers **108** through a method of assigning a unique ID to the license pack, associating the ID with a license server **108**, digitally signing the license pack, and encrypting the license pack with a license

server's public key, as described in detail in the co-pending patent application entitled, "System and Method for Software Licensing", incorporated by reference above.

The company **104** has at least one designated license server **108**. The  
5 license server **108** maintains an inventory of software licenses purchased from the  
licensing clearinghouse **102** and distributes the software licenses contained in the  
license pack to individual clients, as represented by clients **110(1)-110(6)**. The  
license server **108** monitors the software licenses that have been granted to clients  
**110** and generally distributes licenses to new clients **110** as long as it has available  
10 non-assigned licenses.

Because clients **110** might not have direct access to the license server **108**,  
one or more terminal servers, as represented by servers **112(1)** and **112(2)**, can act  
as an intermediary for the clients **110**. Each terminal server **112** is a common  
server that provides conventional resources to the clients **110**. In addition, each  
15 terminal server **112** is coupled to the license server **108** to facilitate license  
distribution from the license server **108** to the clients **110**.

The clients **110** may be directly coupled to the terminal servers **112** via a  
LAN (local access network) or WAN (wide area network), as represented by  
clients **110(1)-110(4)**, or by any other communication link. Additionally, the  
20 clients **110** may be indirectly coupled to the terminal servers **112** through a dialup  
connection as represented by clients **110(5)** and **110(6)**.

### **Exemplary Computer Used to Implement Servers and/or Clients**

The license generator **106**, license server **108**, and terminal server **112** of  
25 **Fig. 1**, are preferably implemented as computer servers, such as Windows NT®

operating system servers from Microsoft Corporation, or UNIX-based servers. It is noted however, that the license generator **106** and license server **108** may be implemented using other technologies, including mainframe technologies, as long as they share a secure, inter-operable communication mechanism such as remote procedure call (RPC).

Individual clients **110** may be implemented as various computing devices, such as desktop personal computers, workstations, laptop computers, notebook computers, handheld PCs, and the like. The clients **110** may further represent a terminal device, which is a low cost machine with limited local processing and local memory. The terminal device includes a display, a keyboard, an optional mouse, limited computer resources such as memory, and enough intelligence to connect to a terminal server **112**. The terminal device merely provides a connection point to the server-based processing.

The clients **110** might also represent a network-centric computer, such as a Network Computer (or NC) or a Net PC.

**Fig. 2** illustrates an example of a computing environment **200** which is suitable for implementing, either fully or partially, computer and network architectures described herein, such as the client **110**, license generator **106**, license server **108**, and terminal server **112**. The exemplary computing environment **200** is only one example of a computing system, and is not intended to suggest any limitation as to the scope of use or functionality of the network architectures. Neither should the computing environment **200** be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the exemplary computing environment **200**.

The computer and network architectures can be implemented with numerous other general purpose or special purpose computing system environments or configurations. Examples of well known computing systems, environments, and/or configurations that may be suitable for use include, but are not limited to, personal computers, server computers, thin clients, thick clients, hand-held or laptop devices, multiprocessor systems, microprocessor-based systems, set top boxes, programmable consumer electronics, network PCs, minicomputers, mainframe computers, distributed computing environments that include any of the above systems or devices, and the like.

Caching user network access information may be described in the general context of computer-executable instructions, such as program modules, being executed by a computer. Generally, program modules include routines, programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types. Caching network access information may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote computer storage media including memory storage devices.

The computing environment **200** includes a general-purpose computing system in the form of a computer **202**. The components of computer **202** can include, but are not limited to, one or more processors or processing units **204**, a system memory **206**, and a system bus **208** that couples various system components including the processor **204** to the system memory **206**.

The system bus **208** represents one or more of any of several types of bus structures, including a memory bus or memory controller, a peripheral bus, an accelerated graphics port, and a processor or local bus using any of a variety of bus architectures. By way of example, such architectures can include an Industry  
5 Standard Architecture (ISA) bus, a Micro Channel Architecture (MCA) bus, an Enhanced ISA (EISA) bus, a Video Electronics Standards Association (VESA) local bus, and a Peripheral Component Interconnects (PCI) bus also known as a Mezzanine bus.

Computer system **202** typically includes a variety of computer readable  
10 media. Such media can be any available media that is accessible by computer **202** and includes both volatile and non-volatile media, removable and non-removable media. The system memory **206** includes computer readable media in the form of volatile memory, such as random access memory (RAM) **210**, and/or non-volatile memory, such as read only memory (ROM) **212**. A basic input/output system  
15 (BIOS) **214**, containing the basic routines that help to transfer information between elements within computer **202**, such as during start-up, is stored in ROM **212**. RAM **210** typically contains data and/or program modules that are immediately accessible to and/or presently operated on by the processing unit **204**.

Computer **202** can also include other removable/non-removable,  
20 volatile/non-volatile computer storage media. By way of example, Fig. 5 illustrates a hard disk drive **216** for reading from and writing to a non-removable, non-volatile magnetic media (not shown), a magnetic disk drive **218** for reading from and writing to a removable, non-volatile magnetic disk **220** (e.g., a “floppy disk”), and an optical disk drive **222** for reading from and/or writing to a  
25 removable, non-volatile optical disk **224** such as a CD-ROM, DVD-ROM, or other



optical media. The hard disk drive **216**, magnetic disk drive **218**, and optical disk drive **222** are each connected to the system bus **208** by one or more data media interfaces **226**. Alternatively, the hard disk drive **216**, magnetic disk drive **218**, and optical disk drive **222** can be connected to the system bus **208** by a SCSI interface (not shown).

The disk drives and their associated computer-readable media provide non-volatile storage of computer readable instructions, data structures, program modules, and other data for computer **202**. Although the example illustrates a hard disk **216**, a removable magnetic disk **220**, and a removable optical disk **224**, it is to be appreciated that other types of computer readable media which can store data that is accessible by a computer, such as magnetic cassettes or other magnetic storage devices, flash memory cards, CD-ROM, digital versatile disks (DVD) or other optical storage, random access memories (RAM), read only memories (ROM), electrically erasable programmable read-only memory (EEPROM), and the like, can also be utilized to implement the exemplary computing system and environment.

Any number of program modules can be stored on the hard disk **216**, magnetic disk **220**, optical disk **224**, ROM **212**, and/or RAM **210**, including by way of example, an operating system **226**, one or more application programs **228**, other program modules **230**, and program data **232**. Each of such operating system **226**, one or more application programs **228**, other program modules **230**, and program data **232** (or some combination thereof) may include an embodiment of a caching scheme for user network access information.

Computer system **202** can include a variety of computer readable media identified as communication media. Communication media typically embodies

computer readable instructions, data structures, program modules, or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any information delivery media. The term “modulated data signal” means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared, and other wireless media. Combinations of any of the above are also included within the scope of computer readable media.

A user can enter commands and information into computer system **202** via input devices such as a keyboard **234** and a pointing device **236** (e.g., a “mouse”). Other input devices **238** (not shown specifically) may include a microphone, joystick, game pad, satellite dish, serial port, scanner, and/or the like. These and other input devices are connected to the processing unit **604** via input/output interfaces **240** that are coupled to the system bus **208**, but may be connected by other interface and bus structures, such as a parallel port, game port, or a universal serial bus (USB).

A monitor **242** or other type of display device can also be connected to the system bus **208** via an interface, such as a video adapter **244**. In addition to the monitor **242**, other output peripheral devices can include components such as speakers (not shown) and a printer **246** which can be connected to computer **202** via the input/output interfaces **240**.

Computer **202** can operate in a networked environment using logical connections to one or more remote computers, such as a remote computing device **248**. By way of example, the remote computing device **248** can be a personal

computer, portable computer, a server, a router, a network computer, a peer device or other common network node, and the like. The remote computing device **248** is illustrated as a portable computer that can include many or all of the elements and features described herein relative to computer system **202**.

5 Logical connections between computer **202** and the remote computer **248** are depicted as a local area network (LAN) **250** and a general wide area network (WAN) **252**. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets, and the Internet. When implemented in a LAN networking environment, the computer **202** is connected to  
10 a local network **250** via a network interface or adapter **254**. When implemented in a WAN networking environment, the computer **202** typically includes a modem **256** or other means for establishing communications over the wide network **252**. The modem **256**, which can be internal or external to computer **202**, can be connected to the system bus **208** via the input/output interfaces **240** or other  
15 appropriate mechanisms. It is to be appreciated that the illustrated network connections are exemplary and that other means of establishing communication link(s) between the computers **202** and **248** can be employed.

In a networked environment, such as that illustrated with computing environment **200**, program modules depicted relative to the computer **202**, or  
20 portions thereof, may be stored in a remote memory storage device. By way of example, remote application programs **258** reside on a memory device of remote computer **248**. For purposes of illustration, application programs and other executable program components, such as the operating system, are illustrated herein as discrete blocks, although it is recognized that such programs and

components reside at various times in different storage components of the computer system 202, and are executed by the data processor(s) of the computer.

### **Exemplary Architecture for Managing and Enforcing Software Licenses**

5           The invention achieves management and enforcement of software licenses within the exemplary software licensing system 100 of Fig. 1 through the exemplary software/hardware architecture 300 shown in Fig. 3. Fig. 3 illustrates components of the exemplary software licensing system 100 and basic software and hardware architecture elements within these components which operate to  
10           implement the invention. The licensing system 100 components illustrated in Fig. 3 include the license generator 106, a license server 108, a terminal server 112, and a client 110. The architecture elements shown within each of the system 100 components are a mechanism for facilitating the following functional description of the system 100 components, and are not meant to be a limitation of the  
15           architecture of any component. As noted above, the computing environment 200 of Fig. 2 may be a suitable implementation of these system 100 components, but it is not the only possible implementation, nor is it intended to suggest any limitation as to the scope of use or functionality of the system 100 components.

          In general, the license generator 106 produces software licenses for a fee,  
20           and the license server 108 consumes the licenses by installing them. The licenses are typically produced in license packs which each contain one or more licenses. The license server 108 can then distribute a license to a client 110. This is usually, although not necessarily, done with the help of the terminal server 112. The client 110 then uses the license to gain access to the resources provided by the terminal  
25           server 112.

Referring to **Fig. 1**, the entity or company **104** that owns or is responsible for the license server **108**, registers itself with an independent certifying authority that is trusted by both the company **104** and the licensing clearinghouse **102**. The company **104** submits information identifying itself and various license servers **108** to the certifying authority. The certifying authority issues a certificate to the company **104** after verifying that the company **104** is a real entity and that the identification information is true and accurate. The certificate contains a public key of the company **104** (or particular license server **108**), which is signed by the certifying authority. This certificate becomes the license server's **108** certificate which it uses when requesting a license pack from the licensing clearinghouse **102**. Similarly, the licensing clearinghouse **102** also registers with the certifying authority to receive a public certificate. The clearinghouse **102** certificate contains the clearinghouse's public key, signed by the certifying authority. Details of the registration and verification process through the certifying authority with respect to the company **104** (or its particular license server **108**) and the licensing clearinghouse **102** are described in the co-pending patent application entitled, "System and Method for Software Licensing", incorporated by reference above.

Referring now to **Fig. 3**, the license generator **106** includes processor(s) **302**, a master license database **304**, a license purchase module **306**, and a license producing module **308**. The license purchase module **306** executes on processor(s) **302** to receive a purchase request from the license server **108** to purchase software licenses. Typically the purchase request is for one or more software license packs. The purchase request includes information pertaining to the licenses and license server **108**. For example, the purchase request might contain such information as a license server ID, the license server's certificate

(which contains the license server's public key), a client's platform type, the quantity of licenses desired, a product ID, and a list of features that the licenses should enable. Additional information about a company **104** (e.g., name, contract number, etc.) may also be requested for purposes of tracking and report  
5 generation. The license purchase module **306** stores this information in the master license database **304**.

In response to the request to purchase licenses, the license producing module **308** executes on processor(s) **302** to generate one or more license packs, each of which contains a set of one or more non-assigned software licenses  
10 purchased from the license clearinghouse **102**. The license generator **106** creates licensing packs and transports the licensing packs to the license server **108** in a secure way that prevents them from being copied and installed on multiple license servers **108** or being applied multiple times on the same server **108**. Details of the manner in which these security measures are accomplished can also be found in  
15 the co-pending patent application entitled, "System and Method for Software Licensing", incorporated by reference above.

The license server **108** has a license installation module **310** which executes on processor(s) **312** to install the license pack(s) received from the license generator **106** on a database having an available license pool **314**. The license  
20 installation module **310** may also be used to order the license packs through the license purchase module **306**, when such purchase requests are made electronically. The license server **108** has a request handling module **316** which executes on processor(s) **312** to receive license requests from clients **110**, typically through a terminal server **112**. Upon receiving a license request, the request  
25 handling module **316** stores client identification information in an assigned license

data pool **318**. This information, along with information on what licenses are assigned to a client **110**, determines whether a client **110** needs an update/renewal of its “same” license, issuance of a new license, or issuance of a temporary license. Upon receiving a license request, the request handling module **316**  
5 compares information from the requesting client **110** with information already stored in the assigned license data pool **318** to determine the license status of the client **110**.

The “same” license module **320** is called to execute on processor(s) **312** anytime a client **110** is recognized as either needing its current license updated, or  
10 needing a new license. Therefore, each time the license server **108** receives a request, the “same” license module **320** executes to determine if the client **110** has been previously licensed by accessing and comparing client identification and license status information previously stored in the assigned license pool database **318**. If the client has not been previously licensed, the new license module **322**  
15 provides a new license to the client **110** as described below. However, if the client has been previously licensed, and still possesses its license, the “same” license module **320** provides a new expiration date and reissues this “same” license to the client. This situation arises whenever a licensed client **110** accesses the terminal server **112** during a “license update period” prior to the expiration date of the  
20 client’s license. Each license has a “license update period”, which is typically a period of about 7 days prior to the expiration date of a license in which current licenses are updated with new expiration dates and reissued to the same client.

In addition, if the client **110** has been previously licensed, but no longer possess its license, the “same” license module **320** will then search the available  
25 license pool **314** for this “same” license in order to update and reissue it to the

client. If the “same” license cannot be found in the available license pool **314**, then the new license module **322** executes to provide a new license to the client **110**, as described below.

A previously licensed client **110** that no longer possesses its license, has  
5 either lost its license due to the client machine being refreshed (e.g. hard disk reformat, reinstallation, etc.), or it has not accessed a terminal server **112** during the “license update period”, and the license has expired. Expired licenses are returned to the available license pool **314** by the license clean-up module **324**. The license clean-up module **324** executes daily to review licenses in the assigned  
10 license pool **318** and return any assigned licenses to the available license pool **314** when they reach their expiration date. Therefore, when a client’s license is lost, if that “same” license is not in the available license pool **314** when the client next accesses a terminal server **112**, then the license has either not reached its expiration date and has thus not been returned to the available pool **314**  
15 (illustrating that the license was lost), or, it has already reached its expiration date (without being “updated” during its “license update period”), has been returned to the available pool **314**, and has been reissued to a different client **110** that needed a license.

The new license module **322** executes to search the available license pool  
20 **314** for a new license which it provides to a client **110** whenever the client has never been issued a license, or whenever the client’s “same” license is not available. Licenses in the available license pool **314** can be any available license. Therefore, any license previously issued to a client **110** that has been returned by the license clean-up module **324** to the available license pool **314** upon its  
25 expiration, is subject to being given to a different client. When a new license is



available from the available license pool **314**, the new license module **322** sets an expiration date and issues the license to the requesting client **110**. When a new license is not available, a temporary license may be issued to the client **110** as discussed below.

5           The temporary license module **326** executes to provide a temporary license to a previously licensed client **110** which has lost its permanent license prior to the expiration date of the permanent license. The temporary license module **326** provides the temporary license when the client **110** is unable to have its “same” permanent license reissued, and is unable to have a new permanent license issued  
10 (i.e. no new licenses are available from the available license pool **314**). The temporary licensing feature ensures that a company **104** does not have to purchase more licenses than it has clients **110** using the licenses. The temporary license module **326** accesses client identification and license status information from the assigned license pool database **318**, and determines whether the client has  
15 previously been issued a temporary license. If the client already has a temporary license, no temporary license is issued, and the client is permitted access to the terminal server **112** because the temporary period of the temporary period has not yet run out. If the client has not yet been issued a temporary license, then the temporary license module **326** issues a temporary license having a temporary  
20 period during which the client is permitted access to the terminal server **112**. Temporary licenses are non-renewable, and only one temporary license is issued to a client **110**. If the temporary period runs out prior to a client receiving either its “same” permanent license or a new permanent license from the available license pool **314**, then the client is thereafter denied access to the terminal server **112** until  
25 a permanent license becomes available.

The period of time over which the temporary license provides terminal server **112** access to a client **110**, for example, a 90 day period, is a reasonable period designed to allow long term management of the license server **108**. In addition, all permanent license expiration dates (i.e., for “same” licenses and new licenses) set as discussed above, are set to provide a permanent license period that is less than the temporary license period. In this way, the system ensures that prior issued permanent licenses which expire (e.g., because they are wiped from a client machine, or because a client does not access the terminal server **112** during the “license update period”), are returned to the available license pool **314** by the license clean-up module **324** in time to be re-issued to their previous client machines.

Therefore, in an exemplary implementation, all permanent license expiration dates are randomly selected to provide a licensing period which extends from 52 to 89 days beyond the date the license is issued or reissued. The randomized expiration date is used to prevent all the clients **110** from reaching their respective “license update periods” at the same time, and thus, results in an even distribution of the licensing load against the license server **108**.

The terminal server **112** architecture includes processor(s) **328**, a database having application programs and other resources **330**, an access module **332**, and a license request module **334**. The access module **332** executes on processor(s) **328** to permit or reject client **110** access to the resources **330** on the terminal server **112**. The access module **332** first determines whether a client **110** which connects to the terminal server **112** has been previously licensed. If a connecting client **110** has not been previously licensed, the license request module **334** executes to request a new license from the license server **108** for the client. If a new license is

provided to the client **110** as discussed above, the client is granted access to the terminal server **112** by the access module **332**. Otherwise, client access to the terminal server **112** is rejected.

If a licensed client **110** connects to the terminal server **112** prior to the “license update period”, the access module **332** immediately permits access to the terminal server **112**. However, if a licensed client **110** connects to the terminal server **112** during the “license update period”, the license request module **334** is called to request an update to the client’s **110** permanent license from the license server **108**. If the license server **108** is unavailable, the access module **332** permits access to the terminal server **112** anyway, since the client’s permanent license has not yet expired. Otherwise, the license request module **334** requests an update to the client’s permanent license from the license server **108**, which reissues the client’s **110** “same” permanent license with an updated expiration date, as discussed above. The updated “same” license is pushed down to the client **110**, and the client is permitted access to the terminal server **112**.

The license request module **334** also initiates a request to the license server **108** when a previously licensed client **110** connects to the terminal server **112** on or after the expiration date of the client’s permanent license. The license request made to the license server **108** should result in the issuance of the “same” permanent license or a new permanent license as discussed above, and the client should be granted access to the terminal server **112**. However, if a permanent license is not available from the license server **108**, the client **110** will be denied access to the terminal server **112** resources. Additionally, in the event a client **110** has previously been issued a temporary license, and the temporary period for the temporary license has run out, the client **110** will be denied access to the terminal

server 112 resources if the “same” permanent license or a new permanent license is not available from the license server 108.

Client 110 architecture includes processor(s) 336, a license cache 338, a remote application module 340, and a browser module 342. A client 110 wanting to access a terminal server 112 for resources or for remote execution of applications 330, connects to the terminal server 112 through running a typical web browser 342. Upon connecting with the terminal server 112, if the client 110 possesses a license (i.e., a current license, an expired license, or a temporary license) in its license cache 338, it presents the license to gain access to the terminal server 112. The terminal server 112 evaluates the license as discussed above, and permits or denies access to the client 110 on this basis. Otherwise, if the client 110 is not licensed, and thus presents no license when connecting to the terminal server 112, the terminal server 112 attempts to retrieve a new license for the client 110, also as discussed above. Once the client 110 has access to the terminal server 112, a remote application module 340 may execute on processor(s) 336 to run various applications 330 provided on the terminal server 112. Although clients 110 may be implemented as many different kinds of computers, they only require enough processing 336 capability to connect to the terminal server 112 and implement the remote application module which facilitates the remote execution of applications 330 on the terminal server 112. All the applications 330 run at the server with server-based processing.

### **Exemplary Method for Managing and Enforcing Software Licenses**

Having introduced an exemplary software licensing system and architecture, an example method of operation will be presented with primary

reference to **Fig. 4** (i.e., **Figs. 4A, 4B, and 4C**). **Fig. 4** is a flowchart illustrating the general method of managing and enforcing software licenses implemented by the exemplary software licensing system and architecture of **Figs. 1 & 3**. Specifically, the flowchart of **Fig. 4** illustrates this method at a beginning point which assumes that the license server **108** has already installed software licenses purchased from the license generator **106**, and thus does not illustrate transactions between the license generator **106** and license server **108** which are discussed above with respect to **Fig. 3**. To help clarify an overall exemplary method of operation, various operating scenarios will be individually described, each of which illustrates a portion of the overall method.

First of all however, as shown in **Fig. 4C**, an ongoing aspect of the invention includes issuing permanent licenses with expiration dates to clients **110** and returning the licenses to an available license pool **314** on their expiration dates if they have not been updated. Thus, as illustrated by operations **450, 452, and 454** of **Fig. 4C**, a basic part of the overall method occurring on a daily basis, includes the license server **108** reviewing data in an assigned license pool **318** and returning any expiring licenses to the available license pool **314**. For example, a permanent license that is wiped off of a client machine (e.g., due to an employee turnover) will not end up having its expiration date updated, but instead will expire and be returned to the available license pool **314** on its expiration date. In such a case, if this client machine connects prior to the expiration date, it will be issued a temporary license, valid for a period of time which ensures that the client machine will be, ideally, issued the same permanent license once that same permanent license expires and is returned to the available license pool **314**. In order for this to occur, expiration dates for permanent licenses are set such that license periods

are less than the length of the temporary periods provided by temporary licenses. An example would include setting the temporary license period to 90 days, while setting permanent license expiration dates so that all permanent licenses expire randomly between 52 and 89 days after the date they are issued. This general concept of license expiration dates being set so that temporary license periods outlast permanent license periods, is true with respect to each of the scenarios discussed below.

Referring to **Fig. 4A**, each scenario begins at operation **400** with a client **110** connecting to a terminal server **112** in an attempt to remotely execute applications **330** or otherwise access terminal server resources **330**. A first scenario involves a client **110** that has no license. Upon connection, the terminal server **112** determines at operation **402** whether the connecting client **110** has a license. Since the client **110** has no license, the terminal server **112** will assist the client **110** in retrieving a new license from the license server **108**. First, the terminal server **112** determines if the license server **108** is available at operation **404**. If the license server **108** is not available, the terminal server **112** rejects access by the client **110** at operation **406**, and the client **110** disconnects at operation **408**. However, if the license server **108** is available, the terminal server **112** submits a license request at operation **410**, which the license server **108** receives at operation **412** (**Fig 4B**). At operation **414**, the license server **108** determines that the client **110** does not need a license update, but rather needs a new license. Therefore, the license server **108** locates a new permanent license in an available license pool **314** at operation **416**, and sets an expiration date for the new license and issues the new license to the client at operation **418**. Assuming at operation **414**, that the client **110** had previously been issued a license, but that the

license had been lost, the license server **108** would first attempt to locate this “same” license in the available license pool **314** prior to searching for a new permanent license. However, in the current scenario there is no previously issued license, and the new permanent license is pushed down to the client **110** through the terminal server **112**. The client **110** is permitted terminal server access at operation **422** (Fig. 4A). The client **110** may then initiate remote terminal server applications **330** or otherwise access terminal server resources **330** within the limits of its license at operation **424**.

In the event the license server **108** is unable to locate a license in the available license pool **314** at operation **416** (Fig 4B), the license server **108** determines whether the client **110** has been issued a temporary license at operation **426**. The license server **108** additionally determines at operation **427**, that the client **110** has not previously been issued a permanent license that has been expired. Since the client **110** has not been issued a temporary or permanent license in this first scenario, and a new permanent license is not available, the license server **108** will issue a temporary license to the client **110** at operation **428**. The temporary license is pushed down to the client **110** through the terminal server **112**, and the client **110** is permitted terminal server access at operation **422** (Fig 4A).

A second scenario involves a client **110** that has recently received a permanent license which has not yet reached its expiration date, and which is in a period prior to a “license update period”. A “license update period” is a short predetermined period prior to the expiration date of a license, typically about a 7 day period, in which the terminal server **112** will attempt to have the license updated through the license server **108**. In the second scenario, a licensed client

**110** connects to a terminal server **112** prior to the “license update period”. The terminal server **112** determines at operation **402**, that the connecting client **110** has previously been issued a permanent license. The terminal server **112** determines at operation **430** whether the client is connecting prior to the “license update period”.

- 5 If this is true, as in the current scenario, the terminal server **112** permits access to the client **110** at operation **422**, and the client **110** may then initiate remote terminal server applications **330** or otherwise access terminal server resources **330** within the limits of its license at operation **424**.

10 A third scenario involves a client **110** that has recently received a permanent license which has not yet reached its expiration date, but which is within the “license update period”. The terminal server **112** determines at operation **402** that the connecting client **110** has been issued a license, and at operation **430**, that the client is not connecting prior to the “license update period”. At operation **432**, the terminal server **112** determines if the client is connecting  
15 during the “license update period”. Since, in the current scenario, the client **110** is connecting during the “license update period”, the terminal server **112** automatically tries to update the client’s permanent license through the license server **108**. If the license server **108** is not available (operation **434**), the terminal server **112** permits access to the client **110** at operation **422**, since it knows that the  
20 client license has not yet expired. The client **110** may then initiate remote terminal server applications **330** or otherwise access terminal server resources **330** within the limits of its license at operation **424**.

However, if the license server **108** is available (operation **434**), the terminal server **112** automatically requests an update for the client license at operation **410**.

- 25 The license server **108** receives the request at operation **412** (Fig **4B**), and



determines at operation **414** that the client **110** already has a permanent license, and is thus requesting that its “same” permanent license be updated. The license server **108** therefore does not need to find a new license for the client **110**, but instead simply resets the expiration date and reissues the “same” license to the client **110** at operation **436**. The updated “same” license is pushed down to the client **110** through the terminal server **112**, and the client **110** is permitted terminal server access at operation **422**.

A fourth scenario involves a client **110** that has received a permanent license which is now either at or beyond its expiration date. This scenario arises when a previously licensed client **110** does not connect with a terminal server **112** while in possession of its license during the “license update period”. This can happen under at least two sets of circumstances. The first, and most common, is when an employee assigned to the licensed client machine **110**, leaves the company **104** or moves to a different position within the company **104**. The client machine **110** is then transferred to a replacement employee and its hard disk, containing the permanent license, is reformatted, reinstalled, or otherwise refreshed, such that the license is wiped off the machine. It is therefore not possible for the client machine **110** to connect with a terminal server **112** while in possession of its license during the “license update period”. The second set of circumstances is simply where an employee to whom the client machine **110** is assigned, does not connect with a terminal server **112** during the “license update period”, even though the license is still present on the client machine **110**. In either case, the permanent license reaches its expiration date.

In this fourth scenario, the terminal server **112** determines at operation **402** that the connecting client **110** has previously been licensed, that the connection is

not prior to the “license update period” (operation **430**), that the connection is not during the “license update period” (operation **432**), and whether the connection is during the temporary period granted by a temporary license (operation **440**). Under the current scenario, since the client **110** has not been issued a temporary  
5 license, the client **110** cannot be connecting during a temporary period granted by a temporary license. Therefore, the terminal server **112** knows that either the client’s permanent license has expired, or the client has been issued a temporary license whose temporary period has run out. The terminal server **112** attempts to update the client’s permanent license or retrieve a new permanent license through  
10 a request to the license server **108**. However, first the terminal server **112** checks to see if the license server **108** is available at operation **442**. If the license server **108** is not available, the terminal server **112** rejects access to the client **110** at operation **406**.

If the license server **108** is available (operation **442**), the terminal server  
15 **112** automatically makes a license request at operation **410**. The license server **108** receives the request at operation **412** (Fig. **4B**), and determines at operation **414** that the client **110** has been licensed before, but that its permanent license has expired. Therefore, the license server **108** searches the available license pool **314** and attempts to locate the client’s expired or “same” permanent license (operation  
20 **414**). If this “same” license has not been issued to a different client, it will be available in the available license pool **314** for updating and issuing to the same client. The license server **108** would therefore reset the expiration date and reissue the “same” license to the client **110** at operation **436**. The updated “same” license would then be pushed down to the client **110** through the terminal server **112** to the  
25 client **110**.

If the license server **108** is unable to locate the “same” permanent license (meaning that this license was already reissued to a different client), it then searches for any new permanent license (operation **416**) in the available license pool **314** and issues a new license with a new expiration date at operation **418**.

5 However, when a new license is not available, the license server **108** determines if the client has a temporary license, at operation **426**. If the client **110** has not yet been issued a temporary license, as in the current scenario, the license server **108** determines at operation **427** if the client’s permanent license expired. If the client’s permanent license has expired, as in the current scenario, no license is  
10 issued to the client **110** (operation **446**), and the client is denied access to the terminal server **112** at operation **406** (Fig. 4A). If however, the client’s permanent license had not yet expired, the license server **108** would know that the license was either in an update period, or had been lost. Since a permanent license is not available, the license server **108** would issue a temporary license with a temporary  
15 access period at operation **428**. The temporary license would be pushed down to the client **110** through the terminal server **112**, and the client **110** permitted terminal server access at operation **422**.

In a final scenario, a client **110** that has received a temporary license connects to the terminal server **112**. As similarly described above, the terminal  
20 server **112** determines at operation **402** that the connecting client **110** has previously been licensed, that the connection is not prior to the “license update period” (operation **430**), that the connection is not during the “license update period” (operation **432**), and whether or not the connection is during the temporary period granted by a temporary license (operation **440**). Under the current scenario,  
25 the client **110** has been issued a temporary license, so the temporary period may

still be good or it may have run out. Whether the client **110** connection is during the temporary period or after the temporary period, the terminal server **112** attempts to update the client's permanent license or retrieve a new permanent license through a request to the license server **108**. However, first the terminal  
5 server **112** checks to see if the license server **108** is available, through operation **442** if the connection is after the temporary period, or through operation **434** if the connection is during the temporary period. If the connection is after the temporary period and the license server **108** is not available (operation **442**), the terminal server **112** rejects access to the client **110** at operation **406**. If the connection is  
10 during the temporary period and the license server **108** is not available (operation **434**), the terminal server **112** permits access to the client **110** at operation **422**, since it knows the client **110** is still within the temporary period of its temporary license.

Whether the client **110** connection is during the temporary period or after  
15 the temporary period, if the license server **108** is available (operations **442** and **434**), the terminal server **112** automatically makes a license request at operation **410**. The license server **108** receives the request at operation **412** (**Fig. 4B**), and determines at operation **414** that the client **110** has been licensed before, but that it now has a temporary license and therefore needs a permanent license. Therefore,  
20 the license server **108** searches the available license pool **314** and attempts to locate the client's "same" permanent license (operation **414**). If this "same" license has not yet expired, it will not have been returned yet to the available license pool **314**, and thus will not be available. However, if this "same" license has expired but has not yet been issued to a different client, it will be available in  
25 the available license pool **314** for updating and issuing to this same client. The

license server **108** would therefore reset the expiration date and reissue the “same” license to the client **110** at operation **436**. The updated “same” license would then be pushed down to the client **110** through the terminal server **112** to the client **110**.

If the license server **108** is unable to locate the “same” permanent license (meaning that this license has not yet expired, or, that it has expired but has already been reissued to a different client), it then searches for any new permanent license (operation **416**) in the available license pool **314**, and issues a new license with a new expiration date at operation **418**. If a new license is not available, the license server **108** then determines, in this scenario, that the client **110** has a temporary license, at operation **426**. Since the client **110** already has a temporary license, no license is issued (operation **448**), and the terminal server **112** permits access to the client **110** at operation **422**, since the client **110** is still within the temporary period of its temporary license.

Although the description above uses language that is specific to structural features and/or methodological acts, it is to be understood that the invention defined in the appended claims is not limited to the specific features or acts described. Rather, the specific features and acts are disclosed as exemplary forms of implementing the invention.